

Fig 77
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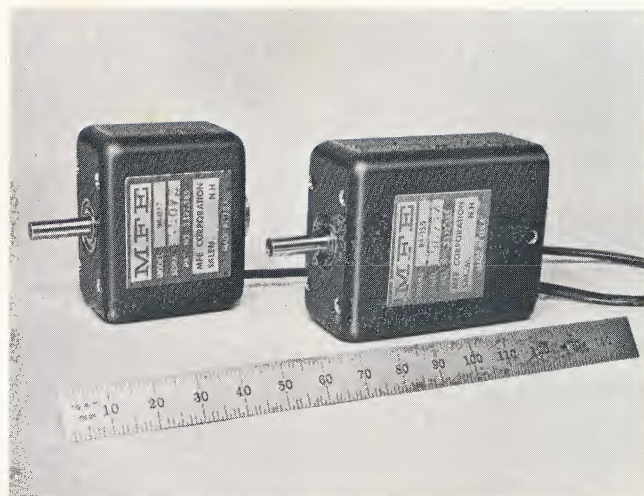
MFE

TECHNICAL DATA

R-4 SERIES

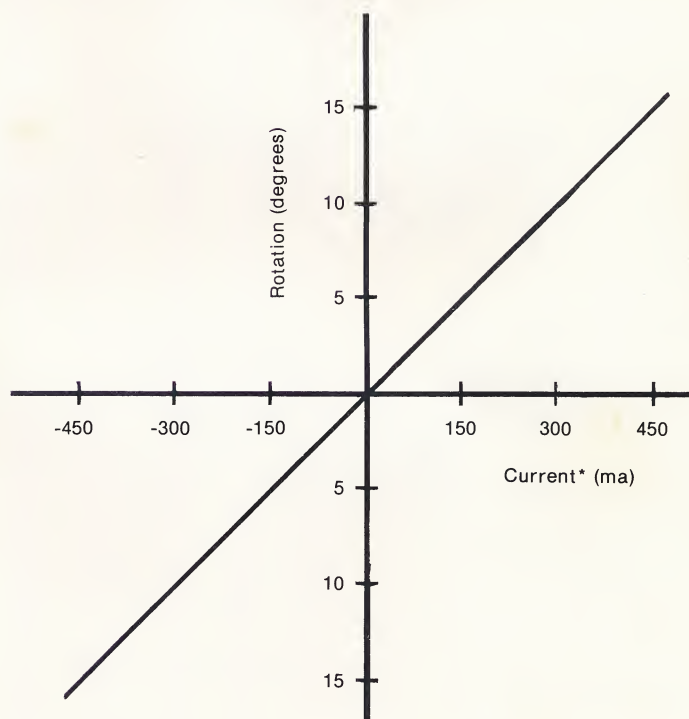
PEN MOTORS

MFE's Series R-4 Pen Motors are an adaptation of the basic moving iron principle which accomplishes the transition from electrical signal to mechanical force or position in a highly efficient manner. These devices produce an output torque proportional to input current over $\pm 14.5^\circ$ of motion.



Output rotation is tangent corrected to facilitate use in edge writing oscillographs. The R-4 Series Motors have been successfully used in many thousands of strip chart recorders which are now employed in the medical monitoring field as well as other industrial applications. When used with a stylus of less than 25 gram-cm² inertia, 100 cps or better 3db frequency response is easily attainable.

The output torque and speed of response of this series of motors greatly exceed those available with other type motors of equal weight, size or power consumption.



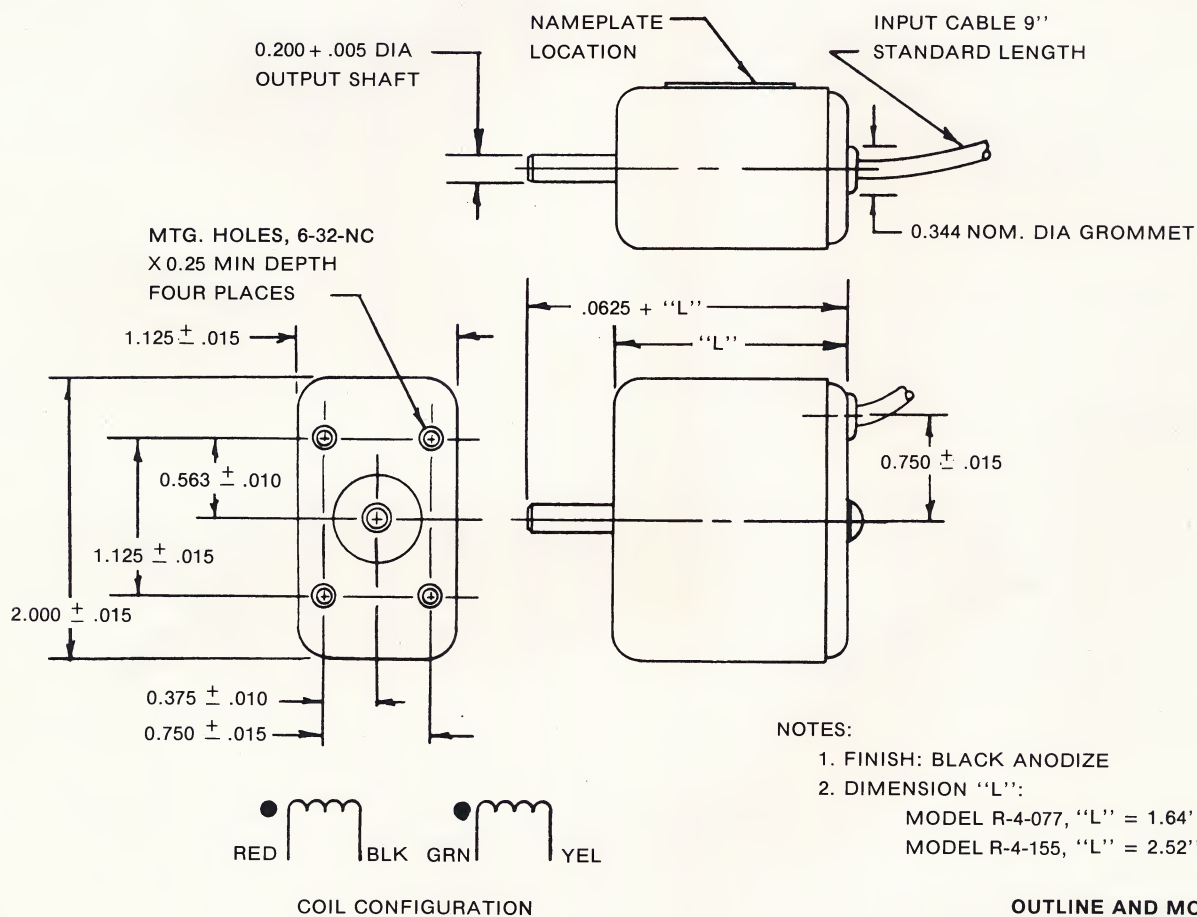
*Drive coils in parallel

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PERFORMANCE DATA

	Units	R4-077	R4-155
Rotation	degrees	± 14.5	± 14.5
Rotor Inertia	gm-cm ²	4	8
Null Torque (Minimum)	gm-cm	350	750
D.C. Power for full scale	watts	1.5	2.0
Natural Frequency (no load)	cps	90	100
Linearity	% of F.S.	$\pm .75$	$\pm .5$
Hysteresis	% of F.S.	$\pm .75$	$\pm .5$
Weight	ounces	9	16
Cross Section	inches	1-1/8 x 2	1-1/8 x 2
Height, overall	inches	1-5/8	2-1/2
Height of stack	inches	.77	1.54
Resistance*	ohms/coil	14	22

* Each motor is wound with two coils which may be used in series or parallel.



OUTLINE AND MOUNTING
SERIES R-4 MOTOR

MFE CORPORATION

KEEWAYDIN DRIVE • SALEM, NEW HAMPSHIRE 03079
TEL. 603-893-1921 • TWX 710-366-1887 • TELEX 94-7477

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PRICE LIST MAGNETIC DEVICES

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PEN MOTOR R-4 SERIES

The R-4 Series Pen Motors are spring restrained, moving iron motors designed for use in strip chart recorders. Typical applications are in thermal, edge writing systems used extensively in biomedical and industrial applications and ink-writing electroencephalographic systems.

MODEL NUMBER	PART NUMBER	QUANTITY	
		1-9	10-24
R4-077	19996008	\$ 89.00	\$ 84.00
R4-155 (AHA)	10114007	139.00	134.00
R7-077 (EEG)	19995018	89.00	84.00

PEN MOTOR S5 SERIES

The S5 Series of Pen Motors are designed for use in systems requiring less than .75 inch channel separation. Both open loop and closed loop (Position feedback) models are available.

MODEL NUMBER	QUANTITY	
	1-9	10-24
R5-100	\$ 70.00	65.00
R5-100PS	85.00	80.00
R5-200	100.00	95.00
R5-200PS	115.00	110.00

TORQUE MOTOR T-4 SERIES

The T-4 Series Torque Motors are spring restrained, ball bearing type, moving iron motors designed for use in servo systems, process control, optical systems, and stable platforms. The T-4 Series is also available with flexure pivots - Consult factory for information.

MODEL NUMBER*	PART NUMBER	QUANTITY	
		1-9	10-24
T4-025-A	10349017	\$ 89.00	\$ 84.00
T4-025-B	10349025	89.00	84.00
T4-025-C	10349033	89.00	84.00
T4-050-A	10350015	91.00	86.00
T4-050-B	10350023	91.00	86.00
T4-050-C	10350031	91.00	86.00
T4-075-A	10351013	94.00	89.00
T4-075-B	10351021	94.00	89.00
T4-075-C	10351039	94.00	89.00
T4-150-A	10352011	114.00	109.00
T4-150-B	10352029	114.00	109.00
T4-150-C	10352037	114.00	109.00

OPTICAL SCANNING MOTORS S-4 SERIES

(complete with mirror and mirror mount)

MFE's Optical Scanning Motors are supplied with mirrors and mirror mounts. The front surface mirrors (1/2 wave/inch flatness) are available in three sizes. The motor prices listed below include a mirror and mirror mount assembly. When ordering, please specify the appropriate mirror mount assembly from the tables on the right.

*A, B, or C indicate zero-return spring stiffness. Motors having no zero-return spring should be designated as (-0) after model number.

MODEL NUMBER*	PART NUMBER	QUANTITY	
		1-9	10-24
S4-025-A	10349041	\$150.00	\$145.00
S4-050-A	10350056	155.00	150.00
S4-050-B	10350064	155.00	150.00
S4-050-C	10350072	155.00	150.00
S4-075-A	10351062	160.00	155.00
S4-075-B	10351070	160.00	155.00
S4-075-C	10351088	160.00	155.00
S4-150-B	10352094	165.00	160.00
S4-150-C	10352102	165.00	160.00

CLOSED LOOP SCANNERS

The S5 series closed loop scanners are a combination of the moving iron galvanometric driver and co-axial position transducer. The addition of the transducer allows the motor to be servo driven to achieve optimum accuracy while providing high speed scanning with large mirrors.

MODEL NUMBER	PART NUMBER	QUANTITY
		1-9
S5-100PS	10359107	\$265.00
S5-200PS	10359131	300.00

RESONANT OPTICAL SCANNERS SR AND SRS SERIES

(with mirrors)

The MFE series SR and SRS optical scanning resonators are designed for use in applications where single frequency, fixed scanning angle, and extreme reliability are required. Select operating frequency between 100 and 2000Hz.

MODEL NUMBER	QUANTITY	
	1-9	10-24
SR	\$195.00	\$190.00
SRS - with electronics	290.00	280.00

MIRROR MOUNT ASSEMBLIES	PART NUMBER	Mirror Size
	10724003	1 cm x 1 cm
	10724011	1 cm x 2 cm
	10724029	2 cm x 2 cm

All Prices F.O.B., Salem, New Hampshire — Terms Net 30 days.

Prices Subject to Change without notice.

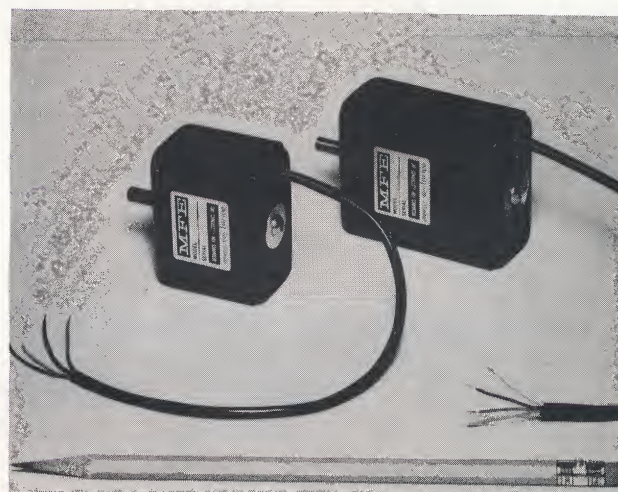
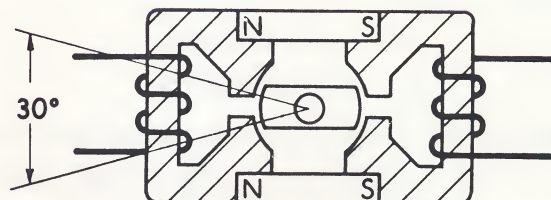
Consult Local Representative or Factory for additional OEM Quantity Discounts.

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TORQUE MOTORS

The proprietary MFE Series T-4 limited rotation torque motors are moving iron devices. The high performance of these units makes them widely applicable in the actuator field. The features are small size, ruggedness, low power and high stability. The output torque and response time are as high as those of competing devices which exhibit hysteresis and nonlinearity greater by an order of magnitude. The T-4 Series is designed for maximum torque in applications requiring $\pm 15^\circ$ rotation such as:

- Servo systems
- Process control
- Optical systems
- Stable platforms



TYPICAL SPECIFICATIONS:

<u>Model No.</u>	<u>T4-025</u>	<u>T4-050</u>	<u>T4-075</u>	<u>T4-150</u>
Maximum Torque at Null (gm-cm)	125	250	350	750
Power at Rated Torque (watts)	0.7	0.9	1.0	1.5
Coil Resistance/coil (ohms)	15	19	22	32
Rotation	$\pm 15^\circ$	$\pm 15^\circ$	$\pm 15^\circ$	$\pm 15^\circ$
Inertia (gm-cm ²)	1.3	2.6	4	8
Linearity	 0.2% — 2.0% peak-to-peak			
Force Hysteresis	0.2% peak-to-peak			
Motion Hysteresis	 0.2% — 1% depending on mounting			

Technical Information:

Standard spring stiffness values are:

A — 1350 B — 2850
C — 5700 gm-cm/rad 0 — No spring

Standard units are supplied with rotor mounted on a spring and bearings. Other configurations with single or dual flexures are available with small angle of rotation for extremes of environment or performance.

Selecting the Proper Torque Motor:

Given: $J_{load} = 2 \text{ gm-cm}^2$
 $\theta = \pm 15^\circ$ required
 $w_n = 75 \text{ cps}$ required

Using Model T4-075, calculate the spring stiffness:

$$k = \frac{T}{\theta} = \frac{350 \text{ gm-cm}}{15^\circ} \cdot \frac{180^\circ}{\pi} = 1340 \text{ gm-cm/rad}$$

$$\pi = 1.32 \times 10^6 \text{ dyne-cm/rad}$$

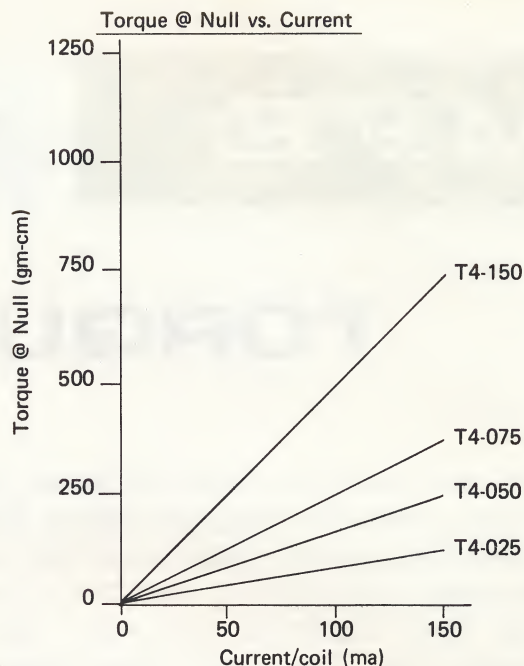
Pick a standard spring stiffness value for the required rotation from the calculation. Then calculate the natural frequency:

$$w_n = \left(\frac{k}{J_{load} + J_{rotor}} \right)^{1/2} = \frac{(1350 \text{ gm-cm/rad} \cdot 980 \text{ dyne/gm})^{1/2}}{(2 \text{ gm-cm}^2 + 4.0 \text{ gm-cm}^2)^{1/2}}$$

$$= 470 \text{ rad/sec.}$$

$$= 75 \text{ cps.}$$

Therefore: Select MFE Model T4-075-A



T4 SERIES MECHANICAL INFORMATION

Model	Width	Length	Depth	Weight
T4-025-A	2"	1-11/32"	1-1/8"	6 oz.
T4-025-B	Consult Factory			
T4-025-C	Consult Factory			
T4-025-0	2"	1-11/32"	1-1/8"	6 oz.
T4-050-A	2"	1-9/16"	1-1/8"	8 oz.
T4-050-B	2"	1-5/8"	1-1/8"	8½ oz.
T4-050-C	2"	1-5/8"	1-1/8"	8½ oz.
T4-050-0	2"	1-9/16"	1-1/8"	8 oz.
T4-075-A	2"	1-27/32"	1-1/8"	9½ oz.
T4-075-B	2"	1-5/8"	1-1/8"	8½ oz.
T4-075-C	2"	1-5/8"	1-1/8"	8½ oz.
T4-075-0	2"	1-9/16"	1-1/8"	8 oz.
T4-150-A	2"	2-1/2"	1-1/8"	14½ oz.
T4-150-B	2"	2-9/16"	1-1/8"	14½ oz.
T4-150-C	2"	2-9/16"	1-1/8"	14½ oz.
T4-150-0	2"	2-1/2"	1-1/8"	14½ oz.

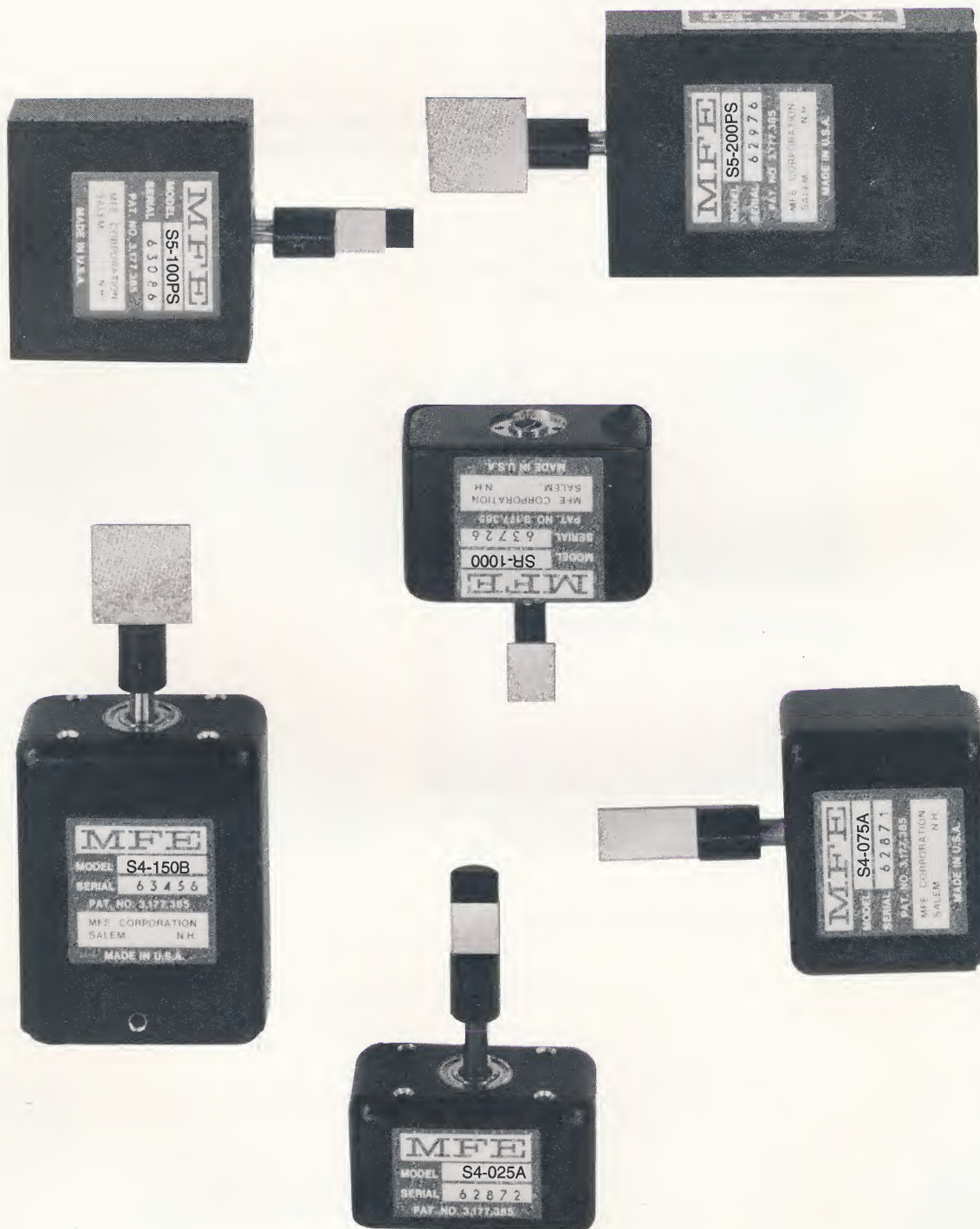
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OPTICAL SCANNING MOTORS

e.g. for laser-mirror drive



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OPEN LOOP SCANNERS

GENERAL DESCRIPTION

The S4 series open loop scanners are a development of the proven MFE moving iron motor technology. These scanning motors feature high reliability, long life, low-power consumption, and up to $\pm 15^\circ$ deflection.

The S4-075 and S4-150 motors are internally compensated for tangent corrected response, such that the deflection of the image on a flat projection plane is directly proportional to driving current.

ACCESSORIES

Accessory equipment such as mirrors, mirror mounts, drive amplifiers, and power supplies can be provided. The aluminized mirrors with silicon oxide protective coating have one wave per inch flatness and are available in a variety of sizes. Special mirrors to satisfy individual requirements are also available.

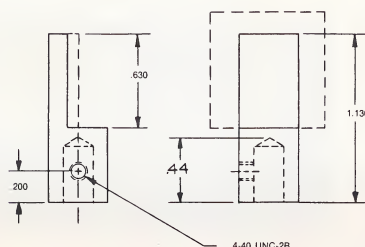
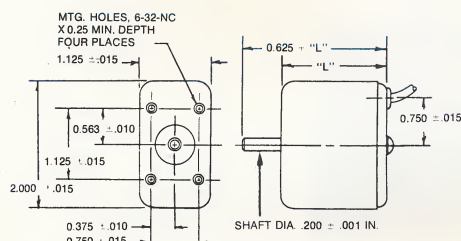
APPLICATIONS

Typical applications include: infrared scanning systems, spectrometry, eye motion studies, information scanning, and universal product code scanning.

TYPICAL SPECIFICATIONS:

MODEL	S4-025	S4-050			S4-075			S4-150	
SPRING SELECTION	A	A	B	C	A	B	C	B	C
Deflection (deg. Peak-to-Peak)	± 15	± 15	± 15	± 7.5	± 15	± 15	± 7.5	± 15	± 7.5
Rotor Inertia (gm-cm ²)	1.3	2.6	2.6	2.6	4	4	4	6.7	6.7
Null Torque (gm-cm)	125	250	250	250	350	350	350	750	750
Natural Frequency (hz)	160	110	160	230	90	130	185	100	130
Linearity (% of F.S.)	2	1	1	1	.75	.75	.75	.5	.5
Hysteresis (% of F.S.)	2	1	1	1	.75	.75	.75	.5	.5
Repeatability (% of F.S.)	.05	.05	.05	.05	.05	.05	.05	.05	.05
Resistance (ohms/coil)	15	19	19	19	14	14	14	22	22
Weight (oz.)	6	8	8.5	8.5	9.5	8.5	8.5	14.5	14.5
Cross Section (inches)	2 x 1 1/8								
Height (inches) (L)	1 11/32	1 9/16	1 5/8	1 5/8	1 27/32	1 5/8	1 5/8	2 9/16	2 9/16

MOUNTING DIMENSIONS



MOTOR

MIRROR MOUNT



PEN MOTORS AND TORQUE MOTORS

MFE was founded in 1962 to market inventions in the field of electromagnetic devices. To date, more than 350,000 MFE pen motors and torque motors have been put into service in the field. Adapted from the basic moving iron principle, these devices feature small size, ruggedness, low power, and high stability. Typical pen motor applications include strip chart recorders for use in areas of: electrocardiography, electroencephalography, seismic recordings, nondestructive test equipment, and hot box detection systems. Torque motor applications include: valve actuators, forced balance systems, and mechanical actuators. For complete pen and torque motor application information and specifications, contact the MFE Corporation.

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